A-Level Biology

Revision Sheet · 考前速记

Learn these by heart before the exam. 考试前把这些内容背熟。

Cells and biological molecules

Magnification 放大率: magnification = image size ÷ actual size; resolution = smallest distance at which two points look separate

Eukaryotic cells have a nucleus and membrane-bound organelles; prokaryotes (bacteria) do not, and have a smaller (70S) ribosome.

Water 水: polar, so a good solvent; hydrogen bonding gives high specific heat and cohesion (transport in xylem)

Carbohydrates (monosaccharide → polysaccharide), lipids (glycerol + fatty acids), proteins (amino acids joined by peptide bonds).

Protein structure 蛋白质结构: primary (sequence) → secondary (α-helix/β-pleated sheet) → tertiary (3-D fold) → quaternary (several chains)

Enzymes and membranes

Enzyme 酶: a biological catalyst; the substrate fits the active site (lock-and-key / induced fit), lowering activation energy

Rate rises with temperature and substrate concentration, then plateaus; too hot or wrong pH denatures the active site.

Competitive inhibitor binds the active site; non-competitive binds elsewhere and changes the site's shape.

Diffusion, osmosis, active transport 扩散、渗透、主动运输: diffusion = high → low concentration (passive); osmosis = water across a partially permeable membrane; active transport = low → high, needs ATP and carrier proteins

Cell surface membrane = fluid mosaic: a phospholipid bilayer with embedded proteins.

Cell division and genetics

Mitosis vs meiosis 有丝分裂与减数分裂: mitosis → 2 identical diploid cells (growth, repair); meiosis → 4 genetically different haploid gametes

Variation in meiosis: independent assortment and crossing over; random fertilisation adds more.

DNA and the genetic code 遗传密码: a triplet of bases codes one amino acid; the code is universal, non-overlapping and degenerate

Transcription (DNA → mRNA) in the nucleus; translation (mRNA → protein) at the ribosome.

monohybrid ratio = 3 : 1, dihybrid = 9 : 3 : 3 : 1 遗传比例

Mutation 突变: a change in DNA base sequence; the raw material for natural selection

Exchange and transport

Exchange surfaces are large, thin and well supplied with blood – a steep concentration gradient.

Transpiration 蒸腾作用: evaporation of water from leaves pulling a continuous column up the xylem (cohesion-tension)

Haemoglobin: the oxygen dissociation curve shifts right with more CO_2 (Bohr effect), releasing O_2 to tissues.

Heart: SAN sets the rhythm; a double circulation keeps oxygenated and deoxygenated blood separate.

Homeostasis and coordination

Homeostasis 稳态: keeping the internal environment steady by negative feedback (blood glucose, temperature, water potential)

Insulin lowers blood glucose (uptake + glycogen storage); glucagon raises it. The kidney controls water by ADH.

Nerve impulse 神经冲动: an action potential: depolarisation (Na^+ in) then repolarisation (K^+ out); jumps between nodes on myelinated axons

Plants respond with auxins – phototropism (shoots to light) and gravitropism.

Ecology, evolution and biotechnology

Natural selection 自然选择: variation + a selection pressure means the best-adapted survive and reproduce, passing on their alleles; allele frequency changes over generations

$p^2 + 2pq + q^2 = 1, \quad p + q = 1$ Hardy-Weinberg allele/genotype frequencies 哈迪-温伯格

Energy is lost at each trophic level (~10% passes on), so food chains are short.

PCR amplifies DNA; gel electrophoresis separates fragments by size (genetic fingerprinting).